**Publication Number:** WO/2000/031199
**Publication Date:** 02.06.2000
**Chapter 2 Demand Filed:** 23.06.2000
**International Application No.:** PCT/BE1999/000151
**International Filing Date:** 23.11.1999

**Int. Class.:** *C09J 7/02* (2006.01)

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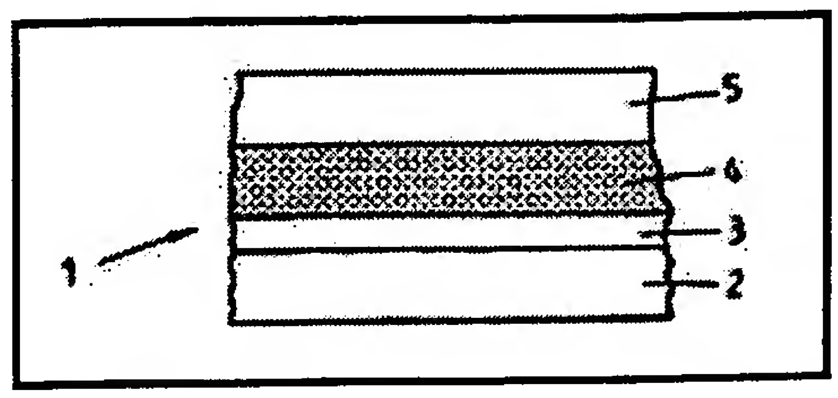
**Priority Data:** 98122119.5 23.11.1998 EP
99108587.9 06.05.1999 EP

**Title:** A PRESSURE-SENSITIVE ADHESIVE LAMINATE, A METHOD AND A DEVICE FOR MODIFYING AN INITIAL RELEASE FORCE IN SUCH A LAMINATE

**Abstract:** The present invention relates to a pressure-sensitive adhesive laminate having at least one release layer and one adhesive layer contacting each other. At least one of those layers comprises a compound that is reactive on application of an ionising and/or actinic radiation. The presence of that compound enables to modify the initial release force of the laminate by application of an ionising and/or actinic radiation.




**Designated States:** AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
African Regional Intellectual Property Org. (ARIPO) (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW)
Eurasian Patent Organization (EAPO) (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM)
European Patent Office (EPO) (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE)
African Intellectual Property Organization (OAPI) (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

**Publication Language:** English (EN)

**Filing Language:** English (EN)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(43) International Publication Date
02 June 2000 (02.06.2000)

PCT

(10) International Publication Number
WO 00/31199 A1

(51) International Patent Classification[7]:
C09J 7/02, B65C 9/00, B05D 3/06

(21) International Application Number:
PCT/BE99/00151

(22) International Filing Date:
23 November 1999 (23.11.1999)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data

| | | |
|---|---|---|
| 98122119.5 | 23 November 1998 (23.11.1998) | EP |
| 99108587.9 | 06 May 1999 (06.05.1999) | EP |

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(81) Designated States (national): AE, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW

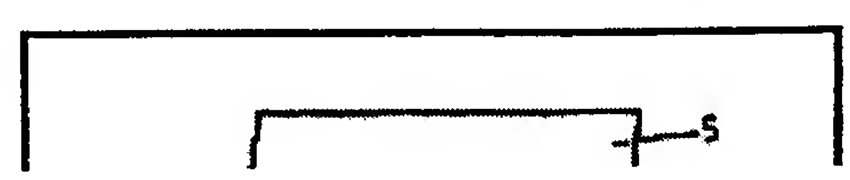
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG)

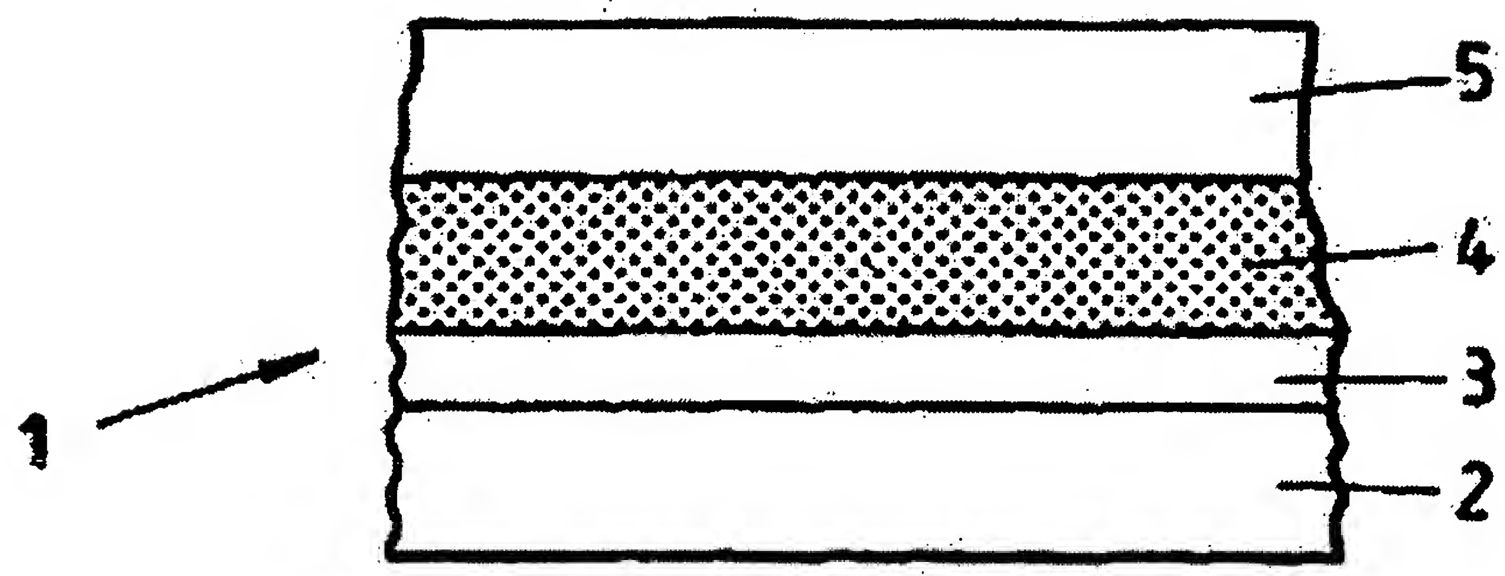
**Published**

-- *with international search report*
-- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(54) **Title:** A PRESSURE-SENSITIVE ADHESIVE LAMINATE, A METHOD AND A DEVICE FOR MODIFYING AN INITIAL RELEASE FORCE IN SUCH A LAMINATE

**(57) Abstract**

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The present invention relates to a pressure-sensitive adhesive laminate having at least one release layer and one adhesive layer contacting each other. At least one of those layers comprises a compound that is reactive on application of an ionising and/or actinic radiation. The presence of that compound enables to modify the initial release force of the laminate by application of an ionising and/or actinic radiation.

A PRESSURE-SENSITIVE ADHESIVE LAMINATE, A METHOD AND A DEVICE FOR MODIFAYING AN INITIAL RELEASE FORCE IN SUCH A LAMINATE The invention relates to a pressure-sensitive adhesive laminate comprising an adhesive layer and a release layer contacting each other.

Pressure-sensitive adhesive (PSA) laminates are well- known in the art and commonly used as tapes, decals labels and the like.

PSA laminates made with radiation-curable silicones are described in the article of R. P. Eckberg"Chemistry and technology of radiation curable silicone release coatings"published in Advances in Pressure Sensitive Adhesive Technology-1 edited by Donatas Satas, 1992, pages 50-76.

This article describes how during manufacturing of the pressure- sensitive adhesive laminate an ultra-violet radiation is used in order to cure the release layer and to give stable properties to the PSA laminates. In such a manner, the release force between the adhesive layer and the release layer is set and remains constant.

A drawback of the known PSA laminates is that once the initial release force is set, the latter can not be changed at a later stage.

Moreover, if laminates with different release forces have to be manufactured, this can not be realised in a continuous manner. For each value of the release force, a dedicate laminate with dedicated release layer composition has to be prepared, thus necessitating to stop the production and change the formula of the release layer.

It is an object of the present invention to provide a solution to the aforementioned problem.

For this purpose, a PSA laminate comprising a release layer and an adhesive layer contacting each other is provided, said PSA laminate being characterised in that said adhesive layer comprises a first compound that is reactive on application of an ionising radiation or an actinic radiation, in order to modify an initial release force between said adhesive layer and said release layer. The addition of the first compound in the adhesive layer enables to obtain a laminate that can be irradiated after

manufacturing in order to modify the initial release force.

By providing a laminate whose release force can be modified after production, a continuous production process becomes possible as it is no longer necessary to establish the final release force during manufacturing.

Instead of having the reactive compound in the adhesive layer it is also possible to have the reactive compound in the release layer or in both layers. When the pressure-sensitive adhesive laminate comprises a carrier, the use of a reactive compound in the release layer not only enables to modify the release force between the release layer and the adhesive layer, but also between the carrier and the release layer. In such a manner, the adhesiveness of the laminate can be modified by modifying the release force at one or both interfaces of the release layer.

Preferably, the reactive compound is chosen among: free radical initiators, cationic initiators, acetophenone and derivatives, benzophenone and derivatives, benzoin and derivatives, quinone and derivatives, xanthones, acridones, titanocenes, polymer-bound photoinitiators, dye/coinitiator systems, 4, 4'-bis (N, N-di-n-butylamino)-E- stilbene, biphotonic photoinitiators, acetylacetonate of Co or Cr or Mn, organometallic compounds based on at least one element of the groups 4,5, 6, 7, 8 or 10; or a mixture of them. Those compounds can easily be mixed with thc materials of the release layer, generally comprising silicone, and with the materials of the adhesive layer, generally comprising acrylic polymer or rubber.

The invention also relates to a method for modifying an initial release force between an adhesive layer and a release layer of a pressure-sensitive adhesive laminate, wherein the adhesive layer comprises a first reactive compound, having first predetermined reactive properties.

The method according to the invention is characterised in that a final release force to be obtained between said adhesive layer and said release layer is set, and in that a radiation dose is determined on the basis of the final release force and the reactive properties of the first compound, said radiation dose being then applied on said laminate by means of an ionising radiation or an actinic radiation. Since the pressure-sensitive adhesive laminate according to the invention enables to modify the initial release force, the requested final release force can be set in function of the client's requirements. Once the final release force is set, and taking the reactive properties of the used compound into account, the radiation dose requested to obtain that final release force can be determined. After determination of this dose, the laminate is irradiated in accordance with that dose. Upon receiving the radiation, the compound will react in order to modify the release force between the adhesive layer and the release layer, between the release layer and the carrier, or both. As the dose is determined, the requested final release force will be obtained.

According to a first preferred embodiment of the present invention, a predetermined segment of the

pressure-sensitive adhesive laminate is masked in order to prevent said radiation to reach the masked segment of the laminate. By masking a predetermined segment of the laminate, the release force can be modified only in the unmasked segments of the laminate. This is for example of interest for laminates where only a segment of the front layer, for example that segment containing a particular item, has to be removed. By changing the release force of the latter, the delamination force is modified in order to make delamination easier.

According to a second preferred embodiment of a method according to the invention, a topography of locations of the laminate to be irradiated is determined, and a radiation is applied on said locations.

By determining a topography it becomes possible to irradiate only a certain number of locations and thus to have on a same PSA laminate locations with a different release force. This method is an alternative to the use of masks and creates more flexibility in the determination of the locations to be irradiated as there is no need to manufacture a mask.

According to a third preferred embodiment of a method according to the invention, at least one segment of said laminate is selected and for said segment a radiation gradient is determined, said radiation dose being applied on said segment according to said radiation gradient. The determination of a radiation gradient and the radiation according to that gradient enables to gradually change the release force in the irradiated segment.

The front layer of a pressure-sensitive adhesive according to the invention can be formed by an image carrier on which an image field can be printed. For example, when the front layer comprises a publicity for a certain product, an image of the product is printed on the front layer. When only the image has to be removed, the method according to the present invention provides an elegant solution. For this purpose, the method is characterised in that a cutting is applied along a border line and in that a final release force, to be obtained between said layers, is determined for at least one of the fields, in function of said predetermined third reactive properties, a radiation dose being determined on the basis of the final release force, said radiation dose being applied on said field for which said radiation dose was determined, by means of an ionising radiation or an actinic radiation. By cutting along the border line the image field is dissociated from the rest of the image carrier. The application of a radiation on either the image field or the non-image field, or even on both, provided in the latter case the dose is different, will modify the release force in the irradiated field (s) so as to enable an easier removal of the image or non-image field. Preferably, an adhesive sheet is applied on the side on which the borderline was cut.

The use of an adhesive sheet, also called transfer film, facilitates the removal of the image or non-image field.

The present invention further relates to a device for the application of the method described herein before. Preferably, said device comprises a radiation source provided for emitting an actinic radiation or

an ionising radiation onto said laminate and is characterised in that it further comprises a cutting tool having an input for supplying a predetermined cutting profile and comprising a first transport member provided for moving said cutting tool along said profile over said laminate, said radiation source having a further input for receiving a predetermined value indicating a radiation dose to be applied, and said radiation source being mounted on a second transport member provided for moving a radiation beam emitted by said source over a predetermined area of said laminate to be irradiated. By using a transport member, the radiation beam is moved over the area to be irradiated, which enables to access all areas to be irradiated.

A further problem of pressure-sensitive adhesive laminates that is solved by the present invention, is the bleeding of the adhesive layer. Bleeding signifies that the adhesive substance, present in the adhesive layer, shows a tendency to flow towards the edges of the laminate. In particular when the laminates are stacked or wound into a roll, the pressure applied on the adhesive layer due to stacking can make the adhesive substance flow. In order to remedy this problem the method of the present invention is characterised in that a radiation dose for increasing the initial release force between said adhesive and said release layer is determined and thereafter said dose is applied on said edge by means of an actinic radiation or an ionising radiation. By irradiating the edge, the release force between the adhesive layer and the release layer is increased, causing the adhesive substance to better stick to the release layer at the edges and thus decreasing the bleeding.

When the adhesive layer comprises a compound reactive upon irradiation, that adhesive layer could also be hardened by irradiation.

Another problem of pressure-sensitive adhesive laminates that is solved by the present invention, is the shrinkage of the front sheet. For printing or other processing purposes, the laminate is submitted to high temperatures. As the front sheet generally comprises a polymer, the latter tends to shrink upon cooling down. Since printing is generally a multiple-step method, that shrinkage causes alignment problems between the different printed colours. In order to reduce this shrinkage, the present invention proposes a method wherein a radiation dose for increasing the release force between said adhesive and said release layer is determined and thereafter said dose is applied on at least two edges of the laminate by means of an actinic or ionising radiation. By irradiating the layers on at least two edges, the release force between the adhesive layer and the release layer is increased, and thus the release force between the front sheet and the carrier is increased at those edges, causing a stronger binding between the front sheet and the carrier and thus decreasing the shrinkage of the front sheet.

Delamination is often mechanically realised, for instance in order to apply labels onto objects. A problem that occurs during mechanical delamination is that the release force is too high on the impact border, which is the border at which delamination is initiated.

Reducing the overall release force is not an appropriate solution as this would cause an insufficient

adhesion. The solution provided by the present invention is characterised in that an ionising or actinic radiation dose is applied before delamination on said impact border and/or on a further border opposite to said impact border for modifying the release force on said irradiated border. By application of a radiation, the release force is modified on the irradiated border in order to facilitate delamination at the impact border without affecting too much the overall release force of the laminate.

The invention also relates to a device for applying on an object a label which is part of a pressure-sensitive laminate comprising an adhesive layer and a release layer contacting each other, wherein a side of said release layer opposite to the one contacting said adhesive layer is applied on a carrier, and wherein a side of said adhesive layer opposite to the one contacting said release layer is applied on a front sheet, said device comprising a supply station provided for supplying said labels, said device further comprising a delamination station downstream of said supply station and provided for delaminating said labels. Such a device is characterised in that said delamination station comprises a first selection unit provided for selecting among said supplied labels a first series of labels which have to be delaminated, and in that said device also comprises a radiation station coupled to a second selection unit provided for selecting among said supplied labels a second series of labels which have to be at least partially irradiated, said radiation station being provided for applying a radiation dose on said second series of labels.

The invention further provides a solution for modifying an adhesiveness of a pressure-sensitive laminate. Sometimes it is necessary to modify the adhesiveness of the laminate, for example in function of the support on which the laminate will be stuck. For this purpose, a method according to the invention is characterised in that at least one segment of said laminate wherein said adhesiveness has to be modified is determined, said segment being divided in a first set and second set of mutually exclusive fields, a radiation dose being determined on the basis of the reactive properties of the third reactive compound and the adhesiveness value to be obtained, said radiation dose being applied by means of an actinic or an ionising radiation on the fields for which the adhesiveness value is determined.

The invention will now be described in more detail with respect to the drawings showing preferred embodiments. In the drawings figure 1 shows a cross-section through a pressure-sensitive adhesive laminate according to the invention; figure 2 illustrates the method and the device for irradiating a laminate according to the invention; figure 3, 4 and 5 show schematically the effect of an irradiation of a laminate; figure 6 shows examples of laminates where only segments are irradiated; and figure 7 shows schematically a device for automatically selecting and delaminating labels.

In the drawings a same reference sign has been assigned to a same or analogous element.

Figure 1 shows a cross-section through an elementary embodiment of a pressure-sensitive adhesive (PSA) laminate 1 according to the present invention. The laminate comprises a carrier 2 generally made of paper or plastic on which a release layer 3 is applied.

A first side or underside of the release layer 3 is in contact with the carrier, whereas a second opposite side or upper-side is in contact with an adhesive layer 4. A front layer or front sheet 5 contacts the upper side of the adhesive layer 4. The front layer is also made for example of paper or plastic and can be used as an image carrier when an image has to be printed on the PSA laminate.

In figure 1, only one adhesive and only one release layer are shown. However several adhesive and release layers can be provided and the layers can be of different compositions depending on the required properties. So, for example the adhesive layer could be sandwiched between two release layers.

The release layer preferably comprises a substance chosen among silicone, acrylated silicone, silicone comprising ethylenically unsaturated groups, urethane, polysilane, polysilylether or polyphtalaldehyde. The release layer can be heat-curable or radiation- curable. The pressure-sensitive adhesive layer comprises for instance an acrylic-or rubber-based polymer.

According to the invention, a first compound is added to the adhesive layer and a second compound is added to the release layer. It is however not necessary to add the compound to each layer and the addition of a single compound to either the adhesive or the release layer could be sufficient for application of the present invention. Generally spoken, one could consider that at least one third compound is added to at least one of thc adhcsivc or release layers. For the sake of clarity and in particular with reference to the figures 1 and 2, there will however be considered that the adhesive layer comprises a first reactive compound and the release layer a second reactive compound. The compound is reactive on application of an ionising radiation and/or an actinic radiation. The ionising radiation can be formed by a beam of electrons, of neutrons or of other physical particles whereas the actinic radiation can be formed by a light or photon beam comprising either a well defined wavelength or a range of wavelength for example between 100 nm and 1000 nm, preferably between 150 nm and 750 nm.

The purpose of adding a compound in the release and/or adhesive layer is to be able to modify the initial release force after manufacturing the PSA laminate. Contrary to the teaching of the prior art, where the release force is established during manufacturing of the laminate, the present invention proposes to add during manufacturing a compound that is reactive to ionising or actinic radiation. In such a manner, the initial release force can be changed, in a controlled manner, after manufacturing of the PSA laminate, by irradiation with a suitable radiation dose.

The radiation applied on the PSA laminate to which the compound was added will modify the initial release force at one or more layers, because it will modify the physical and/or chemical interactions of that or those layers which comprise the reactive compound. The result will be either an increased or a decreased release force. The release force is defined as the force, expressed in Newton, required for separating the carrier with the release layer from the adhesive front sheet according to a predetermined angle of 180° and at a predetermined separation speed, such as set forth by the FINAT method (see for example Technical Manual FINAT, 4t'edition 1995 and published by FINAT, LAAN COPES VAN

CATTENBURCH 74, NL-2585 EW THE HAGUE). Generally, the release force is measured by separating the release layer from the adhesive layer, although in some cases in the present invention, the release force is measured by separating the release layer from the carrier.

The degree at which the release force will be changed will depend on the radiation dose and on the reactive properties of the compound, and generally also on the composition of the layer (s) contacting the radiation-activable layer. In order to obtain a set final release force, a radiation dose has to be determined taking into account the set final release force and the reactive properties of the reactive compound used. Once the radiation dose is applied, the final release force will remain stable.

Alternatively, the use of an adhesive which has radiation- sensitive properties could also be considered, i. e. an adhesive or release layer which already has a reactive compound in its composition. For example the adhesive Acronal 3429 and 3458 of BASF (LUDWIGSHAFEN, D) have such properties. The viscosity of the adhesive is reduced whereas the elasticity is increased by ultraviolet irradiation. The irradiation causes the chemical and/or physical bondings between the polymer chains to modify and to harden or soften the adhesive, depending on the radiation and the substance used. Figure 2 illustrates schematically a device and a method according to the invention. The device comprises one or two radiation sources 9, 10, of which one (10) is placed under the laminate 1 and the other one above the laminate. It will be clear that only one radiation source is necessary and that the radiation beam emitted by the source can be oriented by means of a transport member, for example adjustable mirrors in the case of actinic radiation or magnetic and/or electrical fields in the case of ionising radiation. The transport member is preferably controlled by a computer 11 in order to accurately control the movement of the beam.

The computer 11 is further connected to an input unit 12, for example a keyboard enabling the user to enter data such as the set final release force and the characteristics of the compound present in the adhesive and/or release layer. The computer 11 is preferably charged with a program suitable to calculate the radiation dose based on the set final release force and the reactive properties. The computer is further programmed to control the radiation once the dose has been calculated.

The beam of radiation is usually normal to the surface of the PSA laminate. However for particular applications, such as for instance for irradiating the edges of the laminate in order to decrease the bleeding of the adhesive or the shrinkage of the front layer, as will be described hereinafter, the beam will be oriented in parallel to the layers of the laminate. The beam can also be incline under an angle of less than 90°, if for example only a segment has to be irradiated.

The radiation is preferably applied on a laminate that is supplied by a roll 7 and wound on a further roll 8 after irradiation. Of course the side that is irradiated has to be at least partially transparent for the applied radiation in such a manner that the beam reaches the activable layer (s) to be irradiated.

The radiation can be applied over the whole surface of the layer to be irradiated or only on one or more segments of the surface depending on the locations at which the release force has to be modified. Of course, the intended use of the laminate will determine which locations have to be irradiated. Figure 3 shows an example where the PSA laminate is formed by a series of labels 1-a, 1-b, 1-c and 1-d.

Only the borders of two subsequent labels are irradiated as indicated by the shade on the labels. In that figure the front or the back border are irradiated. It is however also possible to irradiate both the front and the back border, or to irradiate both borders with a different dose in order to obtain a different release force between the font and the back edge. The latter application is for example advantageous for a mechanical application of labels on products. The front side or impact border needs a weak release force in order to easily initiate the delamination, whereas the back side needs a stronger release force in order to avoid that the label would insufficiently adhere to the release layer.

Another application of the label pictured in figure 3 is the ability to delaminate and to apply selectively label 1-a and 1-b when the band is going from the left to the right and to apply selectively the labels 1-c and 1-d when the band is going from the right to the left, because the labels are not easily delaminated when the release force at their impact border is high.

Figure 4a + 4c show an example where the radiation is only applied on a central part c of the laminate so that upon delamination a part 3-c of the release layer remains adhered to the adhesive layer 4. In figure 4b, a different dose is applied on the part c with respect to the parts a an b, so that in part c the adhesive layer 4 remains adhered to the release layer 3, whereas in part a and b, the adhesive layer remains adhered to the front layer 5.

Figure 5a + 5b show a self-wound laminate with adhesive layers 4 and 4'and release layers 3 and 3'. In this example a radiation dose A is applied on the parts d and b, whereas on the parts a, c and f, a radiation dose B is applied. In such a manner, only parts of the adhesive layers 4 remain on top of the release layer 3, and parts of the adhesive layer 4'remains on the bottom of the front sheet 5'. Such an application is for example of interest with PSA's having an adhesive layer on both sides but with different adhesive properties, for example one side for adhering to glass, the other to paper. The adhesiveness of the laminate at the top and bottom external surfaces can thus be changed in mutual exclusive fields of the laminate by application of a radiation dose.

The active ionising or actinic radiation that can be used for the modification of the release force can be chosen in the following, non- limitative list: electron beam, neutrons, x-rays, gamma rays, beta rays, alpha particles, electron corona discharge, actinic light.

The actinic light can be provided for instance by mercury lamp, xenon lamp, deuterium lamp, pulsed lamp, excimer laser, excimer lamp, microwave driven lamps, laser or pulsed laser.

The ultraviolet wavelength range is considered to be between 200 nm and 400 nm.

Some examples of the method according to the invention will now be described.

EXAMPLE 1.

A release layer, nearly one micron thick, of a silicone mixture of Tego RC 726,70 parts and Tego RC 750, 30 parts (Th. Goldschmidt AG, Essen, Germany, in parts by weight) is applied onto a 50-micron BOPP transparent carrier film. Under a nitrogen blanketing, with less than 50 ppm oxygen in the irradiation zone, the silicone layer is cured, at a speed of 100m/min, by irradiating the siliconised BOPP with ultraviolet light emitted by two medium-pressure mercury lamps (2x 80W/cm) with reflectors. An adhesive layer of Acronal V210 (BASF, Ludwigshafen, Germany) is applied onto the silicone layer and dried in a thermal oven.

The coating weight of adhesive after drying is 20g/m2. A 100-microns polyethylene film is applied onto the adhesive layer. When ultraviolet light is applied onto the BOPP carrier of the laminate, the release force increases as shown in the following table. The speed of the samples under the UV lamp is 20 m/min, the power of the lamp is 80 W/cm, the lamp is a medium-pressure mercury lamp, parallel to the sample and perpendicular to the transport direction of the laminate. The samples were irradiated 1, 2, 3, 4, or 5 times successively, the UV light being applied onto the BOPP. The release values of the samples are given in the table, measured just after UV irradiation and after six-months storage in the dark. FTM 3, speed 300 mm/min; FTM 4, speed 80 m/min, all values are in N/25mm. Ultraviolet dose FTM 3 FTM 3 FTM 4 FTM 4 6months 6months noirradiation 0. 2 0. 25 0. 2 0.27 1x 20 m/min 0. 6 0. 7 0. 3 0. 35 2 1. 5 1. 5 0. 6 0. 7 3 3 3. 3 1 1. 1 4 >10 >10 2 2. 3 5x20m/min > 10 > 10 4 4.5 EXAMPLE 2.

The release layer is for example made of the following products: Tego 450, Tego 711, Tego 726 and Tego 750 are products from Th.

Goldschmidt AG, Essen, Germany.

Darocur 1173 is from Ciba Specialities.

BDBS is 4, 4'-bis (N, N-di-n-butylamino)-E-stilbene A combination can be used such as given below wherein all values are expressed in parts in weight.

Formula 1.

A mixture of Tego 726: Tego 711: Darocur 1173 of about 70: 30: 2.

Formula 2.

A mixture of Tego 726: Tego 711: Darocur 1173: BDBS of about 70: 30: 2: 1.

Formula 3.

A mixture of Tego 450: Tego 726: Tego 711: Darocur 1173: BDBS of about 30: 30: 20: 2: 1.

Formula 4 to 6. In another series of experiments, 1000 ppm of Cr (3) acetylacetonate and 1000 ppm of Mn (3) acetylacetonate were added in the formulas 1 to 3, in order to make formulas 4 to 6.

About 1 g/m2 of each formula is coated on a 50-microns BOPP film which serves as carrier. Each coated siliconised liner is cured with ultraviolet light under nitrogen (less than 50 ppm oxygen) at 50 m/min, the power of the medium-pressure mercury lamps being 80 W/cm. An adhesive, made of about 82. 5 weight percent Acronal V 205 (BASF) and about 17. 5 weight percent Snowtack 352 A (Akzo-Nobel) is then coated on the siliconised BOPP and dried in a thermal oven in order to form the adhesive layer. The coated weight of dried adhesive is about 20 g/m2. A 100-micron polyethylene film is then applied on the adhesive layer.

The laminates are stored for one month, in absence of light, before subsequent irradiations.

The pressure-sensitive laminates formed with the silicones formulas 1 to 6 are called laminates 1 to 6. The initial release force (test FTM 3) is between about 0. 1 N/25mm and 0. 3 N/25 mm for the laminates 1 to 6.

After removal of the siliconised BOPP, a high-tack silicone tape is applied on the siliconised side of the BOPP, for each of the sample 1 to 6, and the laminates are stored for one week. The release force between the BOPP and the silicone release layer is then measured for the 6 samples.

Increase of the release force between the release laver and the adhesive laver.

1. Irradiation by ultraviolet light.

One sample of each of the six laminates (laminates 1 to 6) is irradiated with ultraviolet light on the 50-micron BOPP liner, by applying a 1 W/cm2 or 5 W/cm2 dose, with a medium-pressure mercury lamp. After irradiation, the release force (FTM3) of the laminates is increased by more than 20 % for each sample and each dose, compared to the values before ultraviolet irradiation.

2. Irradiation by visible light.

One sample of each of the six laminates is irradiated with a pulsed laser (600 nm) on the 50-micron BOPP liner.

The global irradiation dose is around 1 W/cm2 or 5 W/cm2. After irradiation, the release force (FTM 3) of the laminates is increased by more than 20 % for each sample and each dose, compared to the values before laser irradiation.

3. Irradiation by an electron beam.

One sample of each of the six laminates is irradiated with an electron beam, on the 50-micron BOPP liner, with a 1-Mrad dose or a 10-Mrad dose (200 KeV). After irradiation, the release force (FTM3) of the laminates is increased by more than 20 % for each sample and each dose, compared to the values before electron irradiation.

Increase of the release force between the release laver and the BOPP carrier.

Measurement of the release force between the release layer and the BOPP carrier.

Another series of samples of the laminates 1 to 6 is delaminated, and the silicone side of their UV-cured liner is applied on the adhesive side of a tape bearing a high-tack silicone pressure-sensitive adhesive, in order to measure the release force between the 50-micron BOPP and the cured silicone. After 10 days, the tape is separated from the liner, dragging off the silicone release layer. The release force between the UV-cured silicone layer and the BOPP liner is measured by cleavage at the interface between the BOPP carrier and the UV-cured release layer.

Some other series of samples 1 to 6 are used in the following tests.

1. Irradiation by ultraviolet light.

One sample of each of the six laminates (laminates 1 to 6) is irradiated with ultraviolet light on the 50-micron BOPP, by applying a 1 W/cm2 or 5 W/cm2 dose, with a medium-pressure mercury lamp.

After irradiation, the release force of the laminate is measured. After delamination, the release layer stays anchored on the adhesive layer.

For each sample and each dose, the release value measured between the silicone layer and the BOPP is increased by more than 20 % compared to the value before irradiation.

2. Irradiation by visible light. One sample of each of the six laminates is irradiated with a pulsed laser (600 nm) on the 50-micron BOPP liner.

The global irradiation dose is around 1 W/cm2 or 10 W/cm2.

For each sample and each dose, the release value measured between the silicone layer and the BOPP is increased by more than 20 % compared to the value before laser irradiation.

3. Irradiation by an electron beam.

One sample of each of the six laminates is irradiated with an electron beam, on the BOPP film, with a 1-Mrad dose or a 10-Mrad dose (200 KeV). For each sample and each dose, the release value measured between the silicone layer and the BOPP is increased by more than 20 %, compared to the values before electron irradiation.

The release force and/or the adhesive properties of the PSA laminates can be modified in selected areas and to a selected level, by irradiation of the PSA laminate with a selected type and dose of actinic or ionising radiation. The radiation can modify the interactions between an adhesive layer and a release layer and/or the interactions between a carrier and a release layer.

In order to modify the release properties in a specific zone of a PSA laminate, the whole zone can be irradiated, or only specific areas in the zone can be irradiated, in order to modify the average release properties.

In order to modify the adhesive properties, the PSA laminate is irradiated on. selected areas with a specific dose and type of irradiation. In a preferred embodiment, the anchorage of the release layer on the adhesive layer is higher than the anchorage of the release layer on the carrier in the irradiated areas, but lower in the non-irradiated areas, and, during the removal of the release liner, the release layer is transferred onto the adhesive layer on the areas that were irradiated.

The percentage of the adhesive surface covered with a release layer after removal of the release liner is generally directly related to the decrease of adhesiveness (FTM1 and FTM9 values) of the adhesive layer.

EXAMPLE 3.

Other samples of the six PSA laminates (not irradiated) described in the example 2 are used in the following tests.

An aluminium (thickness 0. 5 mm) mask with a gradient of holes (5 x10 mm) is applied on the BOPP liner of the PSA laminates. A dose of ultraviolet light, about 1 W/cm2 or about 10 W/cm2, is applied on the BOPP liner of the laminates, through the aluminium mask. After irradiation, the laminates are cut into stripes (25 mm width), the BOPP liner is removed, and the adhesive side of the stripes of laminates are applied on glass plates, in order to measure the adhesive properties. In the zones that were irradiated with ultraviolet light, the anchorage of the release liner is higher on the adhesive than on the BOPP liner.

Therefore, after removal of the liner, the adhesive surface of the PSA laminate is partially covered with a silicone layer in the zones that were partially masked, the adhesive surface is totally covered with the release layer in the zones that were totally irradiated, and the adhesive surface is free of silicone in the areas that were not irradiated.

As can be seen in the following table, the adhesive properties of the laminate are roughly proportional to the surface of adhesive that is not covered with the silicone release layer. With this method, the adhesive properties of a PSA laminate with a high adhesion (15N) can be decreased to a lower (7. 4 N) value, to a removable (4N), to an ultra removable (0. 7 N) or even to a non adhesion value by irradiation.

All FTM values are in N/25 mm (Finat test methods). %adhesive0204050759095100 coveredwith silicone %surfaceof100806050251050 freeadhesive ___ FTM1 1512.29.37.441.50.70 FTM9 16139.884.2 1.50.70 In the example 3, the release layer is not pressure-sensitive.

In another embodiment, the release layer, based on silicone, is a pressure-sensitive adhesive, the layer contacting said release layer is a pressure-sensitive adhesive based on an acrylic polymer. The laminate is irradiated through a mask, in the same way as that described previously in example 3. After removal of the release liner, the adhesion properties are those of the acrylic adhesive in the areas that are free of silicone, are substantially equivalent to those of the silicone in the zones totally covered with the release layer, and are comprised between the properties of the acrylic adhesive and those of the (adhesive) silicone in the adhesives zones that are partially covered with the release layer.

The silicone-based pressure-sensitive adhesives have high adhesion at low temperatures, or when applied onto substrates having low surface tension, however their price is much higher than that of acrylic-or rubber-based adhesives. A PSA laminate having a PSA layer partially or totally covered with a pressure-sensitive adhesive silicone release layer can be obtained with the method described in the present invention. This PSA laminate has new and interesting properties, that are intermediate between the properties of the adhesive and the properties of the pressure-sensitive adhesive release layer: good adhesion at low temperatures, good adhesion on low-surface-tension substrates and a cost much lower than that of a purely silicone-based adhesive. The acrylic pressure-sensitive adhesive of the laminate can be replaced by a rubber-based adhesive or an adhesive based on another polymer.

The method described for increasing the release force can be adapted for decreasing the release force. For instance, in order to decrease the release of a pressure-sensitive adhesive laminate by irradiation, a compound that is depolymerised by radiation can be incorporated in the release layer, and treated similarly as described previously. Such compounds can be selected among: polysilanes, polyphtalaldehydes, silicones containing silylether groups or tertiary polycarbonates groups in the main chain, silicones, cationic initiators, or a mixture of them.

As already described, it is possible to irradiate either the whole surface of the laminate or only segments

thereof. Figure 6 shows examples of labels made of a PSA laminate where only segments of some labels, indicated by shade, are irradiated. When only segments have to be irradiated, it is possible to mask those segments or portions that need not be irradiated, for example by using an aluminium foil wherein the portions to be irradiated are cut out; in this case the device is provided with a mask-carrier member provided to carry the mask. The mask-carrier member is placed in the path of the radiation beam in order to prevent the beam from reaching the masked segments. Alternatively, it is possible to determine a topography of locations on the laminate which have to be irradiated. That topography is for example formed by sets of co-ordinates identifying the location on the laminate. That set is then entered into the computer, which will control the radiation beam in such a manner that only the predetermined locations are irradiated. The release force and/or adhesiveness is modified in the irradiated segments. When the release force between the release layer and the adhesive layer is increased to a level higher than the release force between the release layer and the carrier in a specific segment, the release layer will remain on the adhesive after delamination, thus modifying the adhesiveness of the PSA laminate. A gradient of adhesiveness on a segment can thus be obtained.

Another problem is the printing and delamination of pressure-sensitive labels applied on a carrier roll. When a roll of pressure-sensitive laminate bearing die-cut labels is printed, the release force at the front edge of the labels must be sufficiently high in order not to have delamination of some labels in the printing machine. However, when the labels are subsequently delaminated, the release force at the front edge of the labels must be low in order to have an easy delamination of the labels, especially with the automatic machines delaminating the labels and applying them onto objects. The labels currently existing on the market generally have a medium release force on their whole surface in order to be rather easily printed and delaminated. In another embodiment of the present invention, the release force at the front edges of the labels is increased by irradiation, before printing, thus preventing the labels to be delaminated in the printing machine. After printing the labels, the roll is wound up. The roll is then unwound in the reverse direction and the high release edge, that was the front edge, is now the back edge. The present front edge has a low release and the labels can easily be delaminated and applied onto objects. The same advantage can be obtained for sheets of PSA labels.

Sometimes, it is requested that the release force increases or decreases gradually over a segment of the laminate. For example in mechanically applying labels a gradual change of the release force will enable to have a weak release at the front that grows to a stronger one thus enabling an easy release at the front and a more stronger towards the end. By determining a gradient on the final release force, that gradient can be applied on the radiation dose thus obtaining a changing radiation dose and thus a changing release force. The gradient value can be introduced by means of the input unit 12.

Pressure-sensitive adhesive laminates are often used for advertising purposes and an image of the product is applied on the front layer which is then made of a material that can be printed on and serves as an image carrier. As the laminates are often original rectangular shaped or have a larger dimension than the image, and as the image is not necessarily rectangularly shaped, the image-field, that is the field

on which the image of the product is applied, has to be separated from the rest or non-image field. For this purpose a cutting tool is used, for example made of a knife or a laser that is driven along a border line, delimiting the image field from the non-image field. Preferably, the cutting tool is controlled by a computer in order to enable an accurate cutting operation either through the whole laminate or at least through the front sheet. The cutting tool enables to separate the image field from the non-image field. As generally only the image field needs to be delaminated, the latter is irradiated in order to modify the initial release force and enable an easier delamination. As the irradiation can be applied only on the image field or only on the non-image field after printing the image, a more accurate process is possible. Of course, it could also be possible to irradiate the non-image field or irradiate both fields with a different dose. It is also possible to irradiate only part of the image or non-image fields. The irradiation is done either before or after cutting, but preferably after cutting as a more reliable radiation is possible on the already cut-out image field.

Also when letters or numbers or other items are to be made of a PSA laminate, the cutting of the letters and of all segments inside the letters can be realised with the aforementioned method, thus avoiding manual separation.

In order to explain the separation of letters, numbers and other signs from the non-image fields, the following example with illustrative values of the release force will now be described. The PSA laminate is the one described in the figure 1, the release force FTM3 is about 0. 3 N/25 mm before irradiation. Signs are cut in the whole thickness of the front sheet of the laminate, the adhesive layer being generally partially or totally cut. An irradiation device similar to the one of figure 2, irradiates selectively parts of the surface or the whole surface of the non-image fields of the laminate. After irradiation, the release force in the non-image fields that were irradiated is significantly increased, for instance to 2N/25mm. The adhesive surface of a transfer film is applied with some pressure onto the whole surface of the front sheet of the PSA laminate; the adhesion between the adhesive of the transfer film and the front sheet of the PSA laminate is 1 N/25 mm (FTM1). The transfer film is separated from the laminate. The irradiated non-image fields of the PSA laminate have a release force (FTM3: 2 N/25 mm) that is higher than the adhesion between the front sheet of the PSA laminate and the adhesive present on the transfer film (FTM3: 1 N/25mm). The image fields have a low release force (FTM3: 0. 3N/ 25 mm). Thus, in the image areas, the cut pieces of the front sheet of the PSA laminate are transferred onto the transfer film, while the non-image fields are remaining on the carrier. The transfer film carrying the image fields cut in the front sheet is then applied with some pressure onto the object that has to be decorated, the transfer film is removed from the object, leaving the object decorated with the image fields of the PSA laminate. The advantage provided by the method of the invention is that the non-image fields (weed zones) are automatically separated from the image fields. In the prior-art methods, the non-image fields are manually separated, necessitating a long manual work for the technician.

Another advantage of the present invention is the possibility to use the positive (image fields) and negative (non-image fields) cut in the front sheet of the same PSA laminate. In the preceding example,

after the removal of the transfer film with the image fields, the non-image fields remain on the release layer because of their high release force (FTM3: 2 N/25 mm). A transfer film with a high adhesion (FTM1: 4 N/25 mm) on the front sheet is applied onto the whole surface of the front sheet of the PSA laminate, then the separation of the carrier from the transfer film leaves the whole negative image onto the transfer film. With this method, a surface of PSA laminate can be used to decorate one object with the positive and another object with the negative of the same image cut in a PSA laminate.

For storage purposes, the PSA laminates are often either stacked or wound into a roll. This however causes the adhesive layer to be compressed due to the pressure of the stacked sheets or the wound roll. Therefore this compression causes a bleeding of the adhesive substance embedded into the adhesive layer (s). Due to the applied pressure, the adhesive substance thus tends to flow to the edges of the laminate. Although the adhesiveness of the adhesive substance on the front layer is generally high, the adhesive substance in contact with the release layer, where the adhesion force is lower, tends to flow towards the edges causing an accumulation of adhesive substance on the edges where a rim is then formed. This accumulation of adhesive substance at the edges causes the different laminates to stick together and to disturb unwinding or de-stacking. As the rim remains sometimes on the printing machines, a cleaning of the latter is necessary. The present invention offers a solution to this bleeding problem by irradiating the edges of the laminates. The irradiation causes the initial release force to be modified so that a stronger release force is obtained at the edge, thus preventing a bleeding at that edge. Indeed, by increasing the release force at the edges, the adhesive substance will more strongly adhere to the release layer at the edges so that the tendency to flow under influence of the applied pressure will be reduced. Depending on the reactive properties of the reactive compound used and on the final release force to be obtained, the radiation dose applied on the edge can be determined.

Preferably, the irradiation is done on a width that is smaller than 1 millimetre so as not to modify the average release force of the laminate.

Another problem to which the present invention offers a solution is the shrinkage of the front sheet. In particular, when the front sheet is printed in order to apply a multicolour image thereon, that printing process is carried out in several steps, comprising the printing of the different colours, the heating and cooling of the laminate. As the front sheet is often made of a polymer material, the latter tends to shrink after heating. That shrinking then leads to positioning problems between the printing of the different colours. In order to decrease this shrinkage, the present invention proposes to irradiate at least two edges of the laminate by means of an actinic or ionising radiation. The two edges are preferably opposite to each other and preferably extend lengthways. By irradiating those edges, the release force increases at those edges, causing an improved adhesion at them and thus decreasing the shrinkage as the front layer adheres more strongly to the carrier along those edges.

Figure 7 shows schematically a device for delaminating labels of a PSA laminate, in order to apply these labels onto objects in a subsequent step. The PSA laminate is supplied from a supply station formed by a

roll 7 from which it is guided towards a first station 21 imposing an angle variation a = 90° to the laminate. This causes a delamination at the front edges of those labels having a weak release force at their front edge. In such a manner, the device selects at station 21 those labels with a weak release force and those labels can be applied onto objects (not shown). Subsequent stations 22 and 23 show angles 0 = 105° and y = 160 ° which causes the labels with a higher release force at their front or impact border and which passed station 21 to be delaminated. On roll 24, at the end, the carrier bearing the remaining labels is then wound, which enables to save those unused labels. The angles are only indicative for a better understanding of the device. Preferably the irradiation device 9 is placed upstream of station 21, in order to irradiate selected labels. The irradiation device is controlled by the computer (such as shown in figure 2). This computer comprises a first selection unit provided for selecting among the supplied labels a first series of labels which have to be delaminated by one of the stations 21, 22 or 23. The computer also comprises a second selection unit provided for selecting among the supplied labels of the first series those which have to be irradiated. So for example when labels have to be delaminated by station 22, the computer will send a control signal to the source 9 each time one of such labels of the second series has reached the beam of the source. Under control of the latter signal the source will emit a radiation burst towards the label in order to modify, the required level, the release force at that location of the label. At the irradiated location the label will thus have the required release force in order to enable delamination at station 22. Of course the labels of the second series can comprise all those of the first series, or some of them.

CLAIMS 1. A pressure-sensitive adhesive laminate comprising an adhesive layer and a release layer contacting each other, characterised in that said adhesive layer comprises a first compound that is reactive on application of an ionising radiation or an actinic radiation, in order to modify an initial release force between said adhesive layer and said release layer and wherein said actinic radiation has a first wavelength outside the ultraviolet wavelength range.

2. A pressure-sensitive adhesive laminate comprising an adhesive layer and a release layer contacting each other, characterised in that said release layer comprises a second compound that is reactive on application of an ionising radiation or an actinic radiation, in order to modify an initial release force between said adhesive layer and said release layer and wherein said actinic radiation has a second wavelength outside the ultraviolet wavelength range.

3. A pressure-sensitive adhesive laminate comprising an adhesive layer and a release layer contacting each other and wherein a side of said release layer opposite to the one contacting said adhesive layer is applied on a carrier, characterised in that said release layer comprises a second compound that is reactive on application of an ionising radiation or an actinic radiation, in order to modify an initial release force between said release layer and said carrier.

4. A pressure-sensitive adhesive laminate comprising an adhesive layer and a release layer contacting each other, characterised in that said release layer, respectively said adhesive layer, comprises a second

compound, respectively a first compound, that is reactive on application of an ionising radiation or an actinic radiation, in order to decrease an initial release force between said adhesive layer and said release layer.

5. A pressure-sensitive laminate as claimed in anyone of the claims 1 to 4, characterised in that said compound is chosen among: free radical initiators, cationic initiators, acetophenone and derivatives, benzophenone and derivatives, benzoin and derivatives, quinone and derivatives, xanthones, acridones, titanocenes, polymer-bound photoinitiators, dye/coinitiator systems, 4, 4'-bis (N, N-di-n-butylamino)-E-stilbene, biphotonic photoinitiators, acetylacetonate of Co or Cr or Mn, organometallic compounds based on at least one element of the groups 4,5, 6, 7, 8 or 10; or a mixture of them.

6. A pressure-sensitive laminate as claimed in anyone of the claims 1 to 5, characterised in that said release layer comprises a substance chosen among: silicone, acrylated silicone, silicone comprising ethylenically unsatured groups, urethanes, polysilane, polysilylether, polyphtalaldehyde.

7. A method for modifying an initial release force between an adhesive layer and a release layer of a pressure-sensitive adhesive laminate, wherein the adhesive layer comprises a first reactive compound, having first predetermined reactive properties, characterised in that a final release force to be obtained between said adhesive layer and said release layer is set, and wherein a radiation dose is determined on the basis of the final release force and the reactive properties of the first compound, said radiation dose being then applied on said laminate by means of an ionising radiation or an actinic radiation, and wherein said actinic radiation has a wavelength outside the ultraviolet wavelength range.

8. A method for modifying an initial release force between an adhesive layer and a release layer of a pressure-sensitive adhesive laminate, wherein the release layer comprises a second reactive compound, having second predetermined reactive properties, characterised in that a final release force to be obtained between said adhesive layer and said release layer is set, and wherein a radiation dose is determined on the basis of the final release force and the reactive properties of the second compound, said radiation dose being then applied on said laminate by means of an ionising radiation or an actinic radiation, and wherein said actinic radiation has a wavelength outside the ultraviolet wavelength range.

9. A method for modifying an initial release force between a release layer and a carrier of a pressure-sensitive adhesive laminate, wherein the laminate comprises an adhesive layer and a release layer contacting each other, wherein the carrier is applied on a side of the release layer opposite to the one contacting said adhesive layer, and wherein a release layer comprises a second reactive compound, characterised in that a final release force to be obtained between said release layer and said carrier is set, and wherein a radiation dose is determined on the basis of the final release force and the reactive properties of the second compound, said radiation dose being then applied on said laminate by means of an ionising radiation or an actinic radiation.

·10. A method according to anyone of the claims 7 to 9, characterised in that a predetermined segment of the pressure-sensitive adhesive laminate is masked in order to prevent said radiation to reach the masked segment of the laminate.

11. A method according to anyone of the claims 7 to 9, characterised in that a topography of locations of the laminate to be irradiated is determined, and wherein said radiation is applied on said locations.

12. A method according to anyone of the claims 7 to 11, characterised in that at least one segment of said laminate is selected and for said segment a radiation gradient is determined, said radiation dose being applied on said segment according to said radiation gradient.

13. A method according to any one of the claims 10 to 12, characterised in that the irradiated segments respectively locations of the laminate are cut out.

14. A method for modifying an initial release force between an adhesive layer and a release layer of a pressure-sensitive adhesive laminate and wherein at least one of said layers comprises a third reactive compound having third predetermined reactive properties upon application of an incident radiation, said adhesive layer being covered by an image carrier sheet on which an image field, delimited by a border line separating the image field from the remaining non-image field part of the laminate is applied, characterised in that a cutting is applied along said border line and wherein a final release force, to be obtained between said layers, is determined for at least one of the fields, in function of said predetermined third reactive properties, a radiation dose being determined on the basis of the final release force, said radiation dose being applied on said field for which said radiation dose was determined, by means of an ionising radiation or an actinic radiation.

15. A method according to claim 14, characterised in that an adhesive sheet is applied on the side on which the borderline in was cut.

16. A device for processing a pressure-sensitive adhesive laminate, said device comprising a radiation source provided for emitting an actinic radiation or an ionising radiation onto said laminate, characterised in that said device further comprises a cutting tool having an input for supplying a predetermined cutting profile and comprising a first transport member provided for moving said cutting tool along said profile over said laminate, said radiation source having a further input for receiving a predetermined value indicating a radiation dose to be applied, and said radiation source being mounted on a second transport member provided for moving a radiation beam emitted by said source over a predetermined area of said laminate to be irradiated.

17. A device for modifying a release force of a pressure- sensitive adhesive laminate, said device comprising a radiation source provided for emitting an actinic radiation or an ionising radiation onto said laminate, characterised in that said radiation source has an input for receiving a predetermined value

indicating a radiation dose to be applied, and said radiation source being mounted on a transport member provided for moving a radiation beam emitted by said radiation source in order to irradiate a predetermined area of said laminate, said actinic radiation source being provided for emitting no ultraviolet radiation.

18. A method for decreasing a bleeding at an edge of a pressure-sensitive laminate comprising an adhesive layer and a release layer contacting each other, and wherein at least one of said layers comprises a third reactive compound having third predetermined reactive properties upon application of an incident radiation, characterised in that a radiation dose for increasing the initial release force between said adhesive and said release layer is determined and thereafter said dose is applied on said edge by means of an actinic radiation or an ionising radiation.

19. A method for decreasing a shrinkage of a front sheet of a pressure-sensitive adhesive laminate comprising an adhesive layer and a release layer contacting each other, and wherein a front sheet is applied on said adhesive layer on a side opposite to the one contacting said release layer, at least one of the layers comprising a third reactive compound having third reactive properties upon application of an incident radiation, characterised in that a radiation dose for increasing the release force between said adhesive and said release layer is determined and thereafter said dose is applied on at least two edges of the laminate by means of an actinic or ionising radiation.

20. A method for delaminating a pressure-sensitive laminate comprising an adhesive layer and a release layer contacting each other, wherein a side of said release layer opposite to the one contacting said adhesive layer is applied on a carrier, wherein a side of said adhesive layer opposite to the one contacting said release layer is applied on a front sheet, and wherein said adhesive layer is delaminated from said release layer starting from an impact border of a label which is part of said laminate, characterised in that an ionising or actinic radiation dose is applied before delamination on said impact border and/or on a further border opposite to said impact border for modifying the release force on said irradiated border.

21. A device for applying on an object a label which is part of a pressure-sensitive laminate comprising an adhesive layer and a release layer contacting each other, wherein a side of said release layer opposite to the one contacting said adhesive layer is applied on a carrier, and wherein a side of said adhesive layer opposite to the one contacting said release layer is applied on a front sheet, said device comprising a supply station provided for supplying said labels, said device further comprising a delamination station downstream of said supply station and provided for delaminating said labels, characterised in that said delamination station comprises a first selection unit provided for selecting among said supplied labels a first series of labels which have to be delaminated, and wherein said device also comprises a radiation station coupled to a second selection unit provided for selecting among said supplied labels a second series of labels which have to be at least partially irradiated, said radiation station being provided for applying a radiation dose on said second series of labels.

22. A method for modifying an adhesiveness of a pressure- sensitive laminate comprising an adhesive layer and a release layer contacting each other, and wherein a front sheet is applied on said adhesive layer on a side opposite to the one contacting said release layer, at least one of said layers comprising a third reactive compound having third reactive properties upon application of an incident radiation, characterised in that at least one segment of said laminate wherein said adhesiveness has to be modified is determined, said segment being divided in a first set and second set of mutually exclusive fields, and wherein an adhesiveness value less then an initial adhesiveness value and greater than a zero adhesiveness value is determined for at least one of said sets, a radiation dose being determined on the basis of the third reactive properties and the adhesiveness value to be obtained, said radiation dose being applied by means of an actinic or an ionising radiation on the fields for which the adhesiveness value is determined.

23. A method for modifying an adhesiveness of a pressure- sensitive laminate comprising an adhesive layer and a release layer contacting each other, and wherein a front sheet is applied on said adhesive layer on a side opposite to the one contacting said release layer, at least one of said layers comprising a third reactive compound having third reactive properties upon application of an incident radiation, characterised in that at least one segment of said laminate wherein said adhesiveness has to be modified is determined, said segment being divided in a first set and second set of mutually exclusive fields, a radiation dose being determined on the basis of the third reactive properties and the adhesiveness value to be obtained, said radiation dose being applied by means of an actinic or an ionising radiation on the fields for which the adhesiveness value is determined, said actinic radiation having no wavelength in the ultraviolet wavelength range.

24. A device according to any one of the claims 16, 17 or 21, characterised in that said radiation source comprises a wavelength control unit provided for adjusting the wavelength of the output radiation.

25. A device according to any one of the claims 16, 17, 21 or 24, characterised in that said radiation source comprises a dose control unit provided for setting a predetermined radiation output dose.

26. A device according to anyone of the claims 16, 17, 21, 24 or 25, characterised in that said device comprises a mask carrying member placed in a path of a radiation beam produced by said radiation source.